METEOROLOGY OF THE LOWER CONGO[1]

IN this work Dr. Danckelman has made a valuable contribution to the meteorology of Africa. The observations, which are printed *in extenso*, were made at Vivi, lat. 5° 35′ S., long. 13° 52′ E., at a height of 374 feet, from May 1882 to August 1883. The hours of observation were 7 a.m., 2 p.m., and 9 p.m., and to these were added for the six months ending May 1883 observations at 6 a.m. and 8 a.m., which thus furnish important data regarding the march of diurnal phenomena for the first three hours after sunrise. The full details which are given of the instruments employed, their exposure, and the methods of observing are particularly satisfactory. While the instrumental observations are very complete, no less care has been taken to make the non-instrumental observations of weather equally complete, and these have been planned and carried out to aid in discussions affecting both local and general meteorology.

In resuming and discussing these sixteen months' observations, Dr. Danckelman has conjoined with the results obtained for Vivi the results of observations made at St. Thomas, Gaboon, Chinchoxo, Loanda, and Melange, these places roughly representing the west of Africa from near the equator to about lat. 10° S. At all these places the annual minimum pressure occurs in February or March and the maximum in July, with a small secondary maximum in January. At Vivi atmospheric pressure at 32° and sea-level is 29·932 inches in February, 30·117 inches in July, and 29·997 inches for the year.

At Vivi the mean annual temperature is 76°·4, the lowest monthly mean being 70°·5 in August, and the highest 79°·5 in February. The highest observed temperature was 97°·2 on November 5, 1882, and the lowest 53°·8 on July 29 of the same year. A noteworthy feature of the climate of Vivi is the relatively low temperature from June to September; during the other eight months the means vary only from 77°·4 to 79°·5. This feature is common to the whole of this region of West Africa; and it corresponds to the dry season of the year, which, as regards the Lower Congo, is characterised by Dr. Danckelman as undoubtedly the most agreeable and the finest, as well as the healthiest, season of the year. On the other hand, on the elevated plateaux of the interior, the heat is very great during the day, and many maladies prevail among the natives, numbers of the ill-clad blacks succumbing to the diseases caused by exposure to the low temperature of the nights. The temperature of the Congo was observed at intervals during the year, the observations being made at a part of the river where the current was rapid. The results give a mean annual temperature of 81°·8, being thus 5°·4 higher than that of the air.

Of the winds observed at Vivi the percentages are south-west, 39; west, 15; west-south-west, 9; north, 8; and calms, 18; winds from any other direction being of rare occurrence. Thus of the 82 per cent. of wind-directions observed, 63 per cent were from the south-west quadrant. During the whole year south-west winds predominate in the afternoon, but during the dry season the wind frequently veers to west towards evening, so that at 9 p.m. west and west-south-west winds are more frequent than south-west, whilst south and south-south-west winds very rarely occur. This striking predominance of south-westerly winds has important bearings on the climatology of the whole of the Lower Congo as respects humidity, cloud, and rainfall. A striking peculiarity of the climate are the strong winds which often set in late in the afternoon and evening, and which are carefully recorded in the journal of the observations. The following are the number of times such winds have occurred each hour from 3 p.m. to 11 p.m.,—6, 11, 24, 28, 30, 32, 22, and 4, the hours of greatest frequency thus being from 5 p.m. to 10 p.m. During the other hours of the day they seldom occur. The degree to which this prevails is seen from the fact that the mean force of the wind is greater at 9 p.m. than at 2 p.m., the latter hour being the time about which the wind generally attains its maximum diurnal velocity over the land.

Thunderstorms are of frequent occurrence from November to May, but none were recorded from June to October. As regards their distribution during the day, scarcely any occurred from 11 p.m. to noon, the period of maximum frequency being from 1 p.m. to 8 p.m.; but particularly from 4 p.m. to 6 p.m., 29 per cent. of the whole having occurred during these two hours. During the rainy season heat lightning is of frequent occurrence in the south, east, and north horizon, but rarely in the west. When the wind shifts from the ordinary south-west direction into east, the change is almost invariably followed by a thunderstorm, or by thundery-looking clouds, which indicate a thunderstorm not far off. Thunderstorms most frequently advance from the east. During the sixteen months the number of storms which advanced from an easterly direction was fifty-three, whereas only fourteen came from a westerly direction. The severest thunderstorms come from the north-east. They are intimately connected with the rainfall, which being wholly dependent on the thunderstorm, the diurnal periods of the two phenomena are the same. The rainiest months at Vivi were November, 11·34 inches; December, 8·94 inches; April, 9·10 inches; and March, 5·67 inches. The annual amount was 42·56 inches. No rain fell from June to September, and the fall in October was very small. During the dry season, however, when no rain falls, the hygrometer not unfrequently indicates an atmosphere highly charged with vapour, and occasionally a light drizzle sets in which the Portuguese call "Cacimbo," but the amount falling is too small to be measurable. These results show, in an unmistakable manner, the powerful and beneficial influence of the prevailing south-westerly winds from the Atlantic on the climate of this extensive region in the continent of Africa.

THE RECENT ECLIPSE OF THE MOON

WE have received the following communications with reference to the recent lunar eclipse:—

THE total eclipse of the moon on Saturday, October 4, was of particular importance as it was—since the one in 1877, which was practically lost through bad weather—the first opportunity of measuring the changes which the heat radiated by the moon undergoes with the proceeding eclipse. And indeed on Saturday evening at six o'clock it appeared highly probable that the fate of this eclipse would be the same as that of its predecessor, the sky being thickly covered with misty clouds, with hardly any motion whatever. Suddenly, however, as if by magic, thirty-two minutes before the beginning of the total phase, they all disappeared, and left a most perfect and exceptional clearness behind them, which not only lasted during the remainder of the eclipse, but also through the two following days and nights. Thus I was enabled to carry out the greater part of my programme in every detail. The apparatus used was the same which the Earl of Rosse described in his communications to the Royal Society in 1869, 1870, and 1873; it condenses by means of two small concave mirrors alternately on two thermopiles the rays of the moon collected by the 3-foot telescope, and the currents thus created are measured by the aid of a galvanometer with mirror and scale. The time of exposure was 1 min. sid. time for each pile, and the observations were throughout the eclipse carried on with only two interruptions of eight and nine minutes, the former caused by my examining the condensing mirrors for dew, the latter by the re-winding of the driving-clock of the telescope. Thus I took altogether 211 readings of the galvanometer, which were taken together in groups of ten for the formation of reliable mean values. It is these means—without the application of the still necessary reductions—which form the ordinates of the preliminary curve inclosed, the abscissæ of which are the times before the beginning and after the end of the total phase. It will be seen that no observations were made during the total phase, as I could not make certain that the moon's image was actually on the condensing mirrors; besides the readings of the galvanometer on near approach to the total phase became so unsteady and irregular that it was plain that the effect, if any, fell below the sensitiveness of the instrument and the unavoidable errors of observation. This is much to be regretted, as the few observations obtained before the total phase began show plainly that the minimum of the radiated heat takes place later than that of the moon's light. Indeed, so slowly did the readings of the galvanometer increase again that about twenty minutes after the total phase was over the almost entire absence of any effect led me to think that the small condensing mirrors must be covered with dew, an apprehension which was happily not verified. I should add that the galvanometer readings here given are not comparable with those published in 1873.

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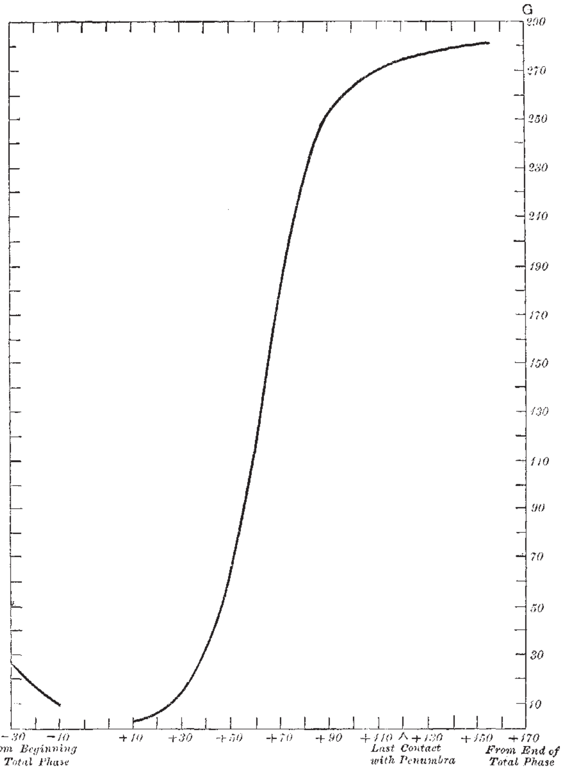
[1] "Mémoire sur les Observations Météorologiques faites à Vivi (Congo Inférieure), et sur la Climatologie de la Côte sud-ouest d'Afrique en général." Par Dr. A von Danckelman. (Berlin, 1884.)



Curve showing the change of the lunar radiant heat as measured by thermopiles and galvanometer during the total eclipse of the moon on October 4, 1884, at Birr Castle Observatory, by Otto Boeddicker.

OTTO BOEDDICKER

The Earl of Rosse's Observatory, Birr Castle,
Parsonstown

THIS eclipse was seen from here (height above sea 530 feet) to great advantage in a cloudless sky, with the stars very brilliant and the air calm.

For some minutes before the actual contact a faint smoky look was visible, and this had the effect of flattening the edge of the moon on the side towards which the shadow was approaching. At 8h. 16m. there was a slight but very perceptible shadow, about a fourth of the moon's diameter in advance of the dark shadow, and in four minutes later the eclipse just entered the moon. At 8h. 44m. the margin of the dark shadow, which had had all along an edge of a woolly and irregular appearance, had now decided streaks in advance of it. The edge of the moon on the opposite side from the base to within 30° of the apex was marked by a rim of intense bright *blue*. Ten minutes later the blue margin was less brilliant and narrower, and the woolly appearance before mentioned was more decided, but less streaky. At 8h. 58m. the *blue* had contracted in length both at the base and apex, and gradually assumed a greenish shade. The cusps of the moon were elongated and more drop-like than continuous. At 9h. 18m. the shadow had almost covered the moon, which showed a faint glow beneath, though the circular appearance was not visible to the naked eye. A minute later, as the last point of light disappeared, a dense blackness of irregular form appeared on the opposite portion of the moon, extending over nearly a third of the surface. At 9h. 39m. the moon was scarcely perceptible to the naked eye. Through the telescope a faint luminosity at the apex could be discerned. At 9h. 47m. to the naked eye the moon seemed like a blurred star, very indistinct and considerably reduced in apparent size, and of no definite form. At 10h. 2m. the faint luminosity at the apex had almost gone, and the outline of the moon was more apparent through the telescope. The blurred, star-like appearance to the naked eye was still unchanged. At 10h. 9m. there was a thin luminosity on both horizontal sides of the moon. The apex of the moon was very indistinct. At 10h. 20m. a broader belt of light appeared on the northern side, but that on the opposite side was indistinct. There was still the same indistinctness to the naked eye, though every now and then a faint crescent-like appearance could be seen. At 10h. 38m. a somewhat broader crescent. At 10h. 43m. a bright light like that of the moon was visible to the naked eye at the apex, and four minutes later the moon reappeared. At 10h. 57m. the tip of a mountain was lit up near the moon's apex. At 11 p.m. the upper cusp extended further than the lower one. At 11h. 15m. a slight haze formed a burr about the moon, which was somewhat kidney-shaped. At 11h. 22m. the burr still visible, but much rounder in form. The eclipse ended at 11h. 45m.

Having previously observed a number of lunar eclipses, I was specially struck with that of to-night; the density and blackness of the shadow was far greater than any previous one that I had seen, especially throughout the period of totality. In all previous eclipses I have been able to trace the outline; in the present case this was quite impossible. Usually the outline is more or less plainly seen, and not unfrequently there is a strong reddish light. The last total eclipse of the moon was seen from this place, and it had a copper-coloured appearance, and there was no difficulty in tracing the outline. In the present eclipse the moon's outline was invisible for some time to the unaided eye, and the apparent size so much diminished that it had more the appearance of a large star whose light was just able to pierce through a dense haze. Some of the valleys of the moon were left for a time in great darkness after the light had travelled beyond them. I may mention that all the above appearances were also seen by Major A. E. L. Lowe and Mr. H. L. P. Lowe, who were using other telescopes. E. J. LOWE

Shirenewton Hall, near Chepstow, October 4

IT is to be hoped that the unusual phenomena attending the late eclipse of the moon may lead to a discussion which will throw some light upon the great differences observed on different occasions in the visibility of the eclipsed moon—differences which have not hitherto, so far as I know, been adequately explained.

In the late eclipse, as viewed from this station (where the sky was not only perfectly cloudless, but free from the least suspicion of haze), the obscuration of the moon was carried to a degree far beyond anything witnessed in the eclipses of recent times. For some time before and after the middle of the eclipse (that is, about 10 p.m.) the only trace of our satellite that remained in the sky was a faint dingy-brown nebulous spot, to which it was impossible to assign any definite form or dimensions, but which certainly did not approach the moon in point of apparent size. So inconspicuous was it that it was quite invisible through the window of a room in which lights were burning; and in the open air, if one had not known exactly where to look for it, one might have searched for some little time without discovering it. I speak of course of the naked-eye appearances. With an opera-glass the nebulous spot was resolved into a well-defined disk of the proper dimensions, but still very faint and dingy, the hue being a kind of reddish-brown. It was further remarked that the illumination was uniformly distributed over the disk, at least so far as this, that there was no preponderance of light in the direction of any one part of the moon's edge. This is what should naturally have followed from the central character of the eclipse, but it seems desirable to note the circumstance with reference to a theory presently to be mentioned.

The most obvious explanation of the unusual obscurity of the moon would be its unusually deep immersion in the earth's shadow, but this view seems to be clearly disproved by a comparison with the phenomena observed in a former eclipse. Referring to a note which I made at the time of the eclipse of August 23, 1877, I find the following remark:—"The moon, even in the middle of the total phase, was a conspicuous object in the sky, and the ruddy colour was well marked. In the very middle of the eclipse the degree of illumination was as nearly as possible equal all round the edge of the moon, the central parts being darker than those near the edge." Now the duration of totality in that eclipse was 1h. 44m. In the late eclipse it was 1h. 32m. The immersion of the moon in the earth's shadow must therefore, I presume, have been at least as deep on the former occasion as on the recent one. It may be mentioned as an additional argument against this explanation that in the late eclipse the visibility of the eclipsed portion was observed to be much less than usual even before the eclipse was complete. In fact it was not until within a few minutes of the total phase that the eclipsed portion could be certainly distinguished with the naked eye.

Another obvious suggestion in the way of explanation has reference to variations in the condition of that portion of the earth's atmosphere through which the sun's rays would pass to reach the moon. This explanation is not without interest in connection with the remarkable sunset effects of last winter, and, in a less degree, of the present autumn. But there are serious difficulties in the way of accepting it, for, in order to account for the observed phenomena, it would be necessary to suppose that an entire ring of the earth's atmosphere was uniformly affected. A want of uniformity in this respect would not cause merely an uneven illumination of the moon's disk, which some observers seem to have noted, and which may very well be set down to the actual differences on the surface of the moon; the effect would be specially marked upon some part of the moon's edge, and would be similar to what is observed soon after totality has commenced and shortly before it ends. Nothing approaching to this appearance was to be seen in the late eclipse at the time when the obscuration was greatest.

Is it possible that the surface of the moon may be in some small degree self-luminous, and that a variation (from unknown causes) in the degree of this self-luminosity may account for the difference observed in the visibility of the moon in two eclipses, in both of which the solar light was equally at its minimum?

Clifton, October 7 GEORGE F. BURDER

ON the occasion of the total eclipse of the moon on Saturday, October 4, the Director of the Pulkowa Observatory, near St. Petersburg, issued a circular to a number of other observatories suggesting the use of the opportunity to fix the exact diameter of the moon, the mean value of the true diameter not being known to a second. Even as regards a probably existing depression of the surface of the moon, we know only that it cannot be very great. The circular also requested observers to watch attentively all stars, even those of the tenth magnitude, eclipsed by the moon, and their egress on the other side, which is only possible during a total eclipse. In order to make these observations exact, Prof. Döllen, of the Pulkowa Observatory, calculated the number of such stars covered by the moon on that date, which he finds were 116, most of which are of the ninth and tenth magnitude and only one of the sixth. He has, moreover, for the use of observers, calculated the exact position of these during the eclipse for no less than sixty observatories from Pulkowa to the Cape, which is expected to give the desired result.

NOTES

OUR readers will hear with sincere regret that Prof. Huxley, under the orders of his medical advisers, left England yesterday for some months of absolute rest. When it is remembered how many functions Prof. Huxley has to fulfil, we need hardly say that the cause of his enforced retirement for a time is overwork. His presence in England will certainly be missed during the coming winter, and he may feel assured that he carries with him the sympathies of many friends, known and unknown. Prof. Huxley goes in the first instance to Venice.

WE heartily support the suggestion which has been made in the *Gardeners' Chronicle* that it would be most appropriate that some memorial of the late Mr. Bentham should, subject to the consent of the authorities, be placed in the Royal Herbarium at Kew, to which he was such a benefactor, and in connection with which his life-work was for very many years carried on. Official etiquette would probably preclude any steps being taken by the authorities at Kew in the matter; and, indeed, it is a subject that would more gracefully and appropriately be dealt with by outsiders.

SIR WILLIAM HARCOURT is always happy when he touches on science, either to point a political shaft, or, as on Tuesday at Derby, when descanting directly on its progress and bearings. He showed himself well versed—as one bearing the honoured name of Harcourt ought to be—in the history of scientific progress, and in the high importance of science apart from its utilitarian uses. Scientific study, in his conception, is above all others "the most useful and the most ennobling." "Depend upon it," he concluded, "if I may turn for a moment to the utilitarian view, these are not days in which we, as a people, can afford to be idle or to be ignorant. There is an immense competition going on in the world in all departments of trade. Remember you have the competition of countries where education of this character is of a more complete character, far more complete than anything we have in this country. If you go into Germany you will find in every small town that there are institutions where the severest education is given in all departments of technical knowledge. The old days when people could afford to go on in an easy, happy-go-lucky sort of manner are gone by. You may depend upon it, in the race which we have to run in the world, a training of the severest description is requisite, so that we may hold our own." We trust Sir William will bear his admirable Derby